We Claim:-

1. A device for fatigue testing of materials comprising a frame, first and second clamping means for holding a specimen to be tested, mounting means to mount the first and second clamping means on the frame, the mounting means vibrationally isolating the first and second clamping means from the frame, means to move at least one of the first and second clamping means to apply in operation a low cycle load on the specimen, means to measure the low cycle load, vibration excitation means acoustically coupled to one of the first and second clamping means to apply in operation a high cycle load on the specimen, means to measure the high cycle load, detector means to detect vibration of the specimen and to produce an electrical signal, control means arranged to receive the electrical signal, the control means determining the resonant frequency of the specimen from the electrical signal and sending a signal to the vibration excitation means to maintain the high cycle load at the resonant frequency of the specimen and means to store data of the test.

2. A device as claimed in claim 1 wherein the mounting means comprises first leaf spring to mount the first clamping means and a second leaf spring to mount the second clamping means.

3. A device as claimed in claim 1 wherein the resonant frequency of the mounting means and first and second clamping means is arranged to be lower than the resonant frequency of the specimen.

4. A device as claimed in claims 1 wherein the vibration excitation means comprises an actuator.

5. A device as claimed in claim 4 wherein the actuator is arranged to generate frequencies in the range 50Hz to 5kHz.

6. A device as claimed in claim 4 wherein the actuator is acoustically coupled to the first or second clamping means via a drive member.

7. A device as claimed in claim 4 wherein the actuator is an electrodynamic, piezoelectric or a magnetostrictive actuator.

8. A device as claimed in claim 1 wherein there are heating means to heat the specimen.

9. A device as claimed in claim 8 wherein the heating means comprises a furnace arranged to surround the specimen.

10. A device as claimed in claim 1 wherein electrical insulating means electrically insulate the frame from the specimen.

11. A device as claimed in claim 10 wherein there are means to supply an electrical current through the specimen, probes arranged on opposite sides of a crack on the specimen to produce a second electrical signal, means to determine crack growth rate arranged to receive the second electrical signal and to determine the rate of crack growth in the specimen.

12. A device as claimed in claim 1 wherein the means to store data stores the life of the specimen to the initiation of the first crack.

13. A device as claimed in claim 1 wherein the means to store data stores the life of the specimen to failure.

14. A method of fatigue testing of materials using a device comprising a frame, first and second clamping means for holding a specimen to be tested, mounting means to mount the first and second clamping means on the frame, the mounting means vibrationally isolating the first and second clamping means from the frame, means to move at least one of the first and second clamping means to apply in operation a low cycle load on the specimen, means to

measure the low cycle load, electrical insulating means to electrically insulate the frame from the specimen, vibration excitation means acoustically coupled to one of the first and second clamping means to apply in operation a high cycle load on the specimen, means to measure the high cycle load, detector means to detect vibration of the specimen and to produce an electrical signal, control means arranged to receive the electrical signal, the control means determining the resonant frequency of the specimen from the electrical signal and sending a signal to the vibration excitation means to maintain the high cycle load at the resonant frequency of the specimen and means to store data of the test, the method comprising

(a) applying a low cycle load and/or a high cycle load to the specimen,

(b) maintaining the vibration of the specimen at its resonant frequency,

(c) detecting a drop in the resonant frequency of the specimen indicative of the initiation of a crack in the specimen,

(d) stopping the test and locating the crack,

(e) attaching probes to the specimen at each side of the crack, the probes are arranged to produce a second electrical signal,

(f) supplying an electrical current through the specimen,

(g) resuming the test and maintaining the vibration of the specimen at its resonant frequency until failure of the specimen occurs,

(h) determining the rate of crack growth in the specimen from the second electrical signal and/or determining the life of the specimen to failure.

15. A method as claimed in claim 14 comprising applying tensile load and bending mode vibrations on the specimen.

16. A method as claimed in claim 14 comprising applying tensile load and torsion mode vibrations on the specimen.

17. A method as claimed in claim 14 wherein the specimen is aerofoil shaped.

18. A method as claimed in claim 14 comprising heating the specimen.

19. A method as claimed in claim 14 wherein step (c) comprises determining the life of the specimen to the initiation of the first crack.

20. A method as claimed in claim 14 wherein step (d) comprises heating the specimen to oxidise and colour the surfaces of the crack on the specimen.

21. A method as claimed in claim 14 wherein step (b) comprises maintaining the vibration of the specimen at a predetermined amplitude of vibration.

22. A method as claimed in claim 21 comprising determining the amount of energy required to vibrate the specimen at the predetermined amplitude of vibrations at the resonant frequency of the specimen.

23. A method as claimed in claim 22 wherein the specimen comprises a damping treatment.

24. A device for fatigue testing of materials comprising a frame, first and second clamping means for holding a specimen to be tested, mounting means to mount the first and second clamping means on the frame, the mounting means vibrationally isolating the first and second clamping means from the frame, means to move at least one of the first and second clamping means to apply in operation a low cycle load on the specimen, means to measure the low cycle load, electrical insulating means to electrically insulate the frame from the specimen, vibration excitation means acoustically coupled to one of the first and second clamping means to apply in operation a high cycle load on the specimen, means to measure the high cycle load,

detector means to detect vibration of the specimen and to produce an electrical signal, control means arranged to receive the electrical signal, the control means determining the resonant frequency of the specimen from the electrical signal and sending a signal to the vibration excitation means to maintain the high cycle load at the resonant frequency of the specimen, probes are provided on the specimen in operation and are arranged to produce a second electrical signal, means to supply an electrical current through the specimen, means to determine crack growth rate arranged to receive the second electrical signal and to determine the rate of crack growth in the specimen and/or determining the life of the specimen to failure.

25. A device as claimed in claim 24 wherein the mounting means comprises first leaf spring to mount the first clamping means and a second leaf spring to mount the second clamping means.

26. A device as claimed in claim 24 wherein the resonant frequency of the mounting means and first and second clamping means is arranged to be lower than the resonant frequency of the specimen.

27. A device as claimed in claim 24 wherein the vibration excitation means comprises an actuator.

28. A device as claimed in claim 27 wherein the actuator is arranged to generate frequencies in the range 50Hz to 5kHz.

29. A device as claimed in claim 27 wherein the actuator is acoustically coupled to the first or second clamping means via a drive member.

30. A device as claimed in claim 27 wherein the actuator is an electrodynamic, piezoelectric or a magnetostrictive actuator.

31. A device as claimed in claim 24 wherein there are heating means to heat the specimen.

32. A device as claimed in claim 37 wherein the heating means comprises a furnace arranged to surround the specimen.

33. A device as claimed in claim 24 wherein the means to store data stores the life of the specimen to the initiation of the first crack.

34. A device as claimed in claim 24 wherein the means to store data stores the life of the specimen to failure.

35. A device as claimed in claim 24 wherein there are means to heat the specimen to oxidise and colour the surfaces of the crack on the specimen.

36. A device as claimed in claim 24 wherein the control means determines the amplitude of vibration of the specimen from the electrical signal and sends a signal to the vibration excitation means to maintain the high cycle load at a predetermined amplitude of vibration.

37. A device as claimed in claim 36 wherein the control unit determines the amount of energy required to vibrate the specimen at the predetermined amplitude of vibration at the resonant frequency of the specimen.

38. A device as claimed in claim 37 wherein the specimen comprises a damping treatment.